MODULAR SAFETY RAIL SYSTEM

BACKGROUND OF THE INVENTION

This invention relates to a support foot for a modular type safety rail system and in particular, though not exclusively, to a support foot for a modular safety rail system suitable for use in providing free-standing roof edge protection.

Modular type safety rail systems are well known and typically comprise straight lengths of metal tubing inter-connected by connectors of different types such that, for example, two, three or four way inter-connections of horizontally and vertically extending tubes may be achieved.

Tubes serving as vertical posts of a safety rail, and relative to which horizontally extending tubes are connected, are supported conventionally by metal base plates. These generally need to be of a robust, heavy construction thereby to provide firm support for the vertical posts. Many different designs of base plates have been proposed, but different designs suffer different disadvantages. Thus some are relatively expensive to manufacture whilst others do not lend themselves to ease of use, for example ease of securing the vertical posts to the base plates and/or ease of securing toe boards of different sizes or in different orientations. Other designs do not

lend themselves readily to being stacked safely in a manner which is inherently adapted to resist toppling of the stacked assembly.

SUMMARY OF THE INVENTION

The present invention seeks to provide an improved support foot for a modular safety rail system in which at least some of the aforedescribed disadvantages of known base plates are mitigated or overcome. The invention seeks also to provide also a safety rail assembly comprising a plurality of said support feet.

In accordance with one aspect of the present invention there is provided a support foot for a modular safety rail system, said support foot being adapted to provide location for a vertical member of the safety rail system and to provide location for a toe board which may be arranged, in use, to extend between two successive, spaced apart support feet, each said support foot comprising:-

a base plate having upper and lower surface regions and an outer periphery;

a plurality of location formations positioned inwards of said outer periphery and each extending from said upper surface for location of a vertical member;

a plurality of web formations provided at said upper surface and each extending from a respective location formation in a direction towards said outer periphery, each web formation extending from the upper surface of the base plate to an upper edge of the web formation, and

the lower surface of the base plate having at least one recess region shaped and positioned such that when one said support foot is stacked on top of a second said support foot **(a)** at least one of a distal end of a location formation and an upper edge of a web formation of said second said support foot engages with said recess region of said one said support foot to prevent lateral movement of said one said support foot relative to said second said support foot, and **(b)** the upper edge of each said web formation of said second said support foot is able to be contacted by the lower surface of said one said support foot thereby to resist toppling of the superimposed support foot.

In addition to being able to resist toppling of superimposed support feet, the upper edge of each of at least some of the web formations may be employed to support the weight of superimposed support feet. Alternatively, or

additionally, the distal end of a, more preferably each, location formation may be employed to support the weight of superimposed support feet.

The invention envisages that preferably the support foot comprises at least three support webs, each of the support webs preferably being uniformly spaced apart. In a preferred embodiment of the invention the support foot comprises four support webs each extending in a direction substantially perpendicular relative to the two support webs between which it is positioned. In the case of a support plate having four webs, two successive webs preferably have the support surfaces thereof facing in an anti-clockwise direction whilst the other two webs have the support surfaces thereof facing in a clockwise direction.

The invention further teaches that preferably each location formation will have a web formation associated therewith, but it does not exclude the possibility of one or more additional location formations devoid of an associated web formation. Preferably each web formation is arranged to provide structural support for, and be supported by, a location formation.

Each location formation typically may be in the form of a socket having a central, typically cylindrical, bore which in use receives an end of a vertical post comprised by for example a rigid rod or tube. A location formation may be provided with retention means, such as a screw threaded aperture for

receiving a grub screw which may be tightened to engage with the outer surface of a rod or tube inserted into the socket formation thereby to enable the vertical member to be positively located axially, in a vertical direction, relative to the support foot. Another suitable type of retention means comprises a hole, preferably a pair of diametrically opposite holes, in the wall of a location formation such that a retention pin may be inserted through the location formation and through one or a pair of aligned holes of an inserted vertical member. The pin may comprise a toggle device to inhibit inadvertent removal.

It is further preferred that the distal ends of the location formations extend further from the base plate than the web formations, and that the lower surface of the base plate is provided with one or a plurality of individual recesses to accommodate the distal ends of the location formations in a manner in which, when one support foot is stacked on top of another, relative lateral movement of the two support feet is restrained by the presence of the distal ends of the location formations in said recess or recesses. Alternatively or additionally the base plate may have at least one recess for engagement by the upper edge surface region of a web formation to restrain said relative lateral movement.

The weight of the upper of a pair of vertically aligned support feet may be supported by upper surfaces of the web formations of the lower of the two

support feet. Alternatively, said weight may be supported normally by the distal end of the or each location formation of the lower of the two support feet, in which case the upper surfaces of the web formations will lie slightly spaced from the lower surface of the superimposed foot but be contacted by that surface to resist toppling if the stack departs from a truly vertically aligned condition. Preferably said spacing is sufficiently small to ensure that there is resistance to toppling of a stack of at least five said support feet, more preferably a stack of at least ten said support feet

Preferably said upper edge of a web formation is available to provide support for a superimposed second support foot at a position of that upper edge which lies furthest from the associated location formation, preferably at a position substantially aligned with the outer periphery of the base plate thereby to assist in providing good resistance to relative toppling movements.

A web formation may be provided with retention means for enabling a toe board to be secured thereto. A web formation may be provided with an aperture to enable a toe board to be secured to the web formation by a screw or nut and bolt assembly. Additionally or alternatively a toe board may be located relative to the support foot by engaging in a slot provided in the base plate of the support foot, with a face of the web formation lying adjacent an edge of the slot thereby to provide a support function for the toe board.

Preferably a slot in the base plate extends for only part of the distance from the outer periphery of the base plate towards a location formation such that, if desired, instead of the toe board being located in the slot and thus resting directly on the same roof or ground surface as that on which the support rests, the toe board may be supported elevated above the roof or ground surface by a distance corresponding to the thickness of the base plate. To enable greater than average thickness toe boards to be secured to a web formation in a slightly elevated position, with the base of the toe board resting on the upper surface of the base plate, it is preferred that a web formation is provided at only one side of the slot. The upper surface of the base plate may be provided with one or more handle formations to enable the support foot readily to be lifted for transportation.

The base plate, location formations, web formations and any handle formations preferably may be formed integrally with one another, for example in the form of a casting of iron or other metal. However, for example, a part of the support foot, such as a handle, may be pre-forged and then integrated with the remainder of the foot during a casting operation.

Each web formation preferably is formed integral with a location formation over a substantial part of the distance for which the location formation extends from the upper surface of the base plate thereby to provide a stiffening or other strengthening of the location formation. In turn, each web formation

may be provided with a reinforcing formation, at a side opposite that face of the web formation which in use is contacted by a toe board thereby to enhance the resistance of the web formation to sideways, bending movement under action of the toe board.

The base plate typically is of substantially uniform thickness, and also typically has upper and lower surfaces which are substantially planar. The outer periphery may be circular, but other peripheral shapes such as square or polygonal are not excluded from the scope of the invention.

The support foot of the present invention exhibits a high degree of strength and rigidity in a construction which avoids excessive use of materials and is relatively well adapted to manufacture by, for example, a casting technique. Importantly, the construction also facilitates a plurality of the support feet to be stacked one on top of another in a substantially stable configuration in which relative lateral movement is resisted by location of the distal ends of the location formations in the recesses of the lower surface of an adjacent support foot, and in which the lower surface of a superimposed support foot is well supported, or supportable, close to the outer periphery thereof by the outer regions of the upper edges of the web formations of the underlying support foot.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the present invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings in which:-

Figure 1 is a perspective view of the upper part of a support foot in accordance with the present invention;

Figure 2 is a perspective view of the underneath of the support foot of Figure 1, and

Figure 3 is a perspective view of a modular safety rail installation comprising a plurality of support feet each in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A cast iron support foot 10 for a modular safety rail system comprises a base plate portion 11 which is generally of a disc type shape comprising an upper surface 12, a lower surface 13 and an outer periphery defined by a substantially cylindrical edge 14.

The base plate 11 is of a substantially planar form having a uniform thickness except that, as described in more detail below, the lower surface 13 is provided with recesses and the upper surface 12 has a plurality of portions which are integral with the base plate and extend therefrom.

The upper surface 12 is provided, near to but spaced from the centre thereof, with four location formations each adapted for location of a vertical post. Each location formation is in the form of a socket 15 having a through-bore 16. The four sockets 15 are uniformly circumferentially spaced about the major axis of said cylindrical edge surface 14. Each socket is provided with a screw threaded aperture 17 for a grub screw (not shown) which can be tightened to bear against the outer surface of a vertical post inserted in the bore 16 thereby to secure that post against rotation or longitudinal movement relative to the socket. (In an alternative embodiment, not illustrated, the socket may be provided with a pair of diametrically opposite holes and a pin with a toggle end retainer is inserted through those holes and a pair of pre-formed holes in the end of a post to provide said location).

Each socket 16 provides support for and is in part supported by a web 18 that extends radially outwards from the socket to the outer cylindrical edge surface 14. The web is a very substantially planar form and lies in a plane perpendicular to the upper surface 12 of the base plate 11.

Each web 18 has an upper edge surface 19 which extends parallel with the base plate surface 12 and lies spaced from said surface 12 by a distance slightly less than the spacing from said surface 12 of the distal end 20 of the socket 15. The upper edges 19 of the four webs all lie at the same height from the base plate surface 12. Similarly, the distal ends 20 of the sockets all lie at the same spacing from the surface 12.

The web formations 24 are provided in an asymmetric configuration in which as viewed in Figure 1, two successive webs 18 have the support surfaces 24 thereof facing in an anti-clockwise direction whilst the other two webs have the support surfaces 24 thereof facing in a clockwise direction. In consequence, when two of the support feet are arranged spaced apart with two web formation of one support foot aligned substantially with two webs of the other support foot, the web support surface of one support foot at one end of the toe board faces in the same direction as the web support surface of the support foot at the other end of the toe board.

Each web is provided with an aperture 21 to allow a toe board of a safety rail installation to be bolted to that web.

In addition to the support which each socket 15 provides for an associated web 18, each web is supported by a reinforcing rib 22 at that surface of the

web opposite that to which it is intended that, in use, a toe board is to be secured and supported.

The base plate comprises four uniformly circumferentially spaced slots 23 each lying adjacent a respective web support surface 24. Each slot 23 extends radially inwards towards a socket 15 for a distance substantially equal to two thirds of the radial length of the web 18.

In addition to the sockets and webs the upper surface 12 has three handle formations 25 extending therefrom. The central handle typically is for use by a crane hook, and the end handles enable two persons to move the foot manually. Each handle 25 extends to a maximum distance from the upper surface 12 of the base plate which is less than the spacing of the web upper edge surface 19 from the base plate surface 12. The base plate additionally comprises three slots 26 each aligned with and positioned underneath a respective one of the handles 25. (In an alternative embodiment, the end handles are each disposed generally perpendicular to the illustrated position and close to the edge 14; to increase their robustness when in that orientation where there are potentially more exposed to damage they may be of a pre-forged type).

The lower surface 13 of the base plate comprises four recess regions 27 each aligned with a respective one of the socket through-bores 16. Each recess 27

has a depth slightly less than the distance by which the distal end 20 of each socket extends beyond the upper edge surface 19 of an associated web. When a plurality of the support feet are stacked one on top of another, the distal ends 20 of the sockets can be orientated to lie in the recesses thereby to restrain relative lateral movement of two successive support feet. In addition, in that stacked configuration, each superimposed support foot has the lower surface thereof supported by the distal ends 20 of the sockets 15. The upper edges 19 of the webs then lie close to but slightly spaced from the superimposed foot so that they can be contacted by that foot to provide a resistance to toppling if the superimposed foot is caused to depart from a truly vertically aligned position. The webs are able to provide that support at radially outer positions substantially aligned with the outer cylindrical edge 14 of the base plate 11 and thereby are particularly effective to offer stable support and resistance to toppling of a stacked plurality of the support feet.

In the safety rail assembly shown in Figure 3 four of the aforedescribed support feet 10 are employed to support six vertical posts 30. Upper horizontal rails 31 and mid-height horizontal rails 32 extend between the posts of each successive pairs of posts and are connected to the vertical posts in known manner by 90^0 connectors 33 and T connectors 34. The support feet are orientated such that two of the web formations of each support foot lie parallel with two web formations of a successive support foot. In consequence a toe board 35 (one only illustrated for clarity) can be secured to

the co-planar faces of web formations of two successive support feet arranged at the respective ends of the board 35.